Applicant respectfully submits that claim 1 is patentable over Yang as combined with Kim ('763) and Kim ('293) as there is no disclosure or suggestion in the references of etching an opening in a substrate using an etchant comprising a carbon oxide, a fluorocarbon, an etch rate modulator, and an inert carrier gas, wherein the etchant is selective to an etch stop layer formed thereunder. Yang teaches etching an opening in a dielectric layer 20 to the surface of a SiN layer 18. Yang discusses, at Col 6, lines 12-21, that this etch preferably uses an etchant gas mixture such as "CF_4 and/or CHF_3 and using a carrier gas such as Ar." Yang does not disclose or suggest an etchant comprising carbon oxide or an etch rate modulator for the etch of layer 20.

Yang does teach an etch that utilizes carbon dioxide but not for the etch of layer 20 and not for an etch that is selective to an underlying etch stop layer. Yang teaches the use of an etchant comprising carbon dioxide at Col. 4 lines 1-9 and Col 6 lines 36-42. In both sections, Yang teaches etching SiN layer 18 (IMD2) and layer 16 (IMD1) rather than etching layer 20 and stopping on etch stop layer 18. Accordingly, Yang fails to disclose or suggest an etchant comprising carbon oxide that is selective to an etch stop layer formed thereunder.

Furthermore, the carbon dioxide containing etch of Yang does not comprise all of the following: a carbon oxide; a fluorocarbon; an etch rate modulator; and an inert carrier gas, as required by the claim. At Col 4, Yang summarizes the etch of SiN layer 18 (IMD2) and layer 16 (IMD1) stating the one of more of a list of gases may be used to etch the two layers, but fails to suggest which gases may be used to etch which layer. Yang clarifies which gases to use for each layer at Col 6, lines 36-42. In Col. 6 Yang teaches that SiN layer 18 may be etched using CHF_3 and O_2 whereas layer 16 may be etched using CF_4, CO_2, and CHF_3 with Ar. Yang does not teach an etch rate modulator for the etch comprising carbon dioxide.

No where does Yang teach an etchant comprising a carbon oxide, a fluorocarbon, an etch rate modulator, and an inert carrier gas, wherein the etchant is selective to an etch stop layer formed thereunder. Since Kim ('293) and Kim ('763) are

not applied to teach this limitation, Applicant respectfully submits that claim 1 and the claims dependent thereon are patentable over the references.

Applicant respectfully submits that claim 1 is further patentable over the references as there is no disclosure or suggestion in the references of an etchant comprising a carbon oxide, a fluorocarbon, an etch rate modulator, and an inert carrier gas, wherein a flow rate of said carbon oxide is greater than about 80 sccm and the etchant is selective to an aluminum oxide etch stop layer formed thereunder. As noted by the Examiner, Yang fails to teach an aluminum oxide etch stop layer. Kim ('763) teaches an auxiliary etch stop layer comprising SiN or aluminum oxide and an etchant gas comprising oxygen, Ar and C_4F_8 with an etch selectivity of 5 for aluminum oxide and 10 for SiN. At most Kim ('763) suggests using either SiN or aluminum oxide (in conjunction with TaO_5) as an etch stop when using an etching gas comprising oxygen, Ar and C_4F_8. Kim ('763) does not suggest etch selectivity for aluminum oxide with respect to any other gas chemistry, much less that the etch chemistry of Yang would be selective to aluminum oxide such that the SiN etch stop could be replaced with aluminum oxide.

Even if there was a suggestion to replace the SiN etch stop of Yang with the aluminum oxide of Kim ('763), the etch of Yang for which SiN layer 18 serves as an etch stop comprises CF_4 and/or CHF_3 and Ar instead of carbon oxide (and a fluorocarbon, an etch rate modulator, and an inert carrier gas).

As further noted by the Examiner, Yang fails to teach a flow rate of carbon oxide greater than about 80 sccm. Kim ('293) teaches an etch chemistry including CO and/or Ar having a flow rate of 50-400 sccm. However, like the carbon dioxide containing etchant of Yang, this chemistry of Kim ('293) is not taught for selectivity to an underlying etch stop layer. Instead it is used after via etch to form a trench within a dielectric layer, stopping within the dielectric layer and having a protective ARC layer 412 protecting the via bottom (as opposed to having selectivity to an etch stop layer). The etch chemistry taught by Kim ('293) as being selective to an etch stop layer formed thereunder is the

via etch chemistry of C_4F_6, O_2, and Ar taught in Col 7, lines 43-50. No CO or CO flow rate is taught in conjunction with this etch.

A proper combination of the references taken as a whole fails to disclose or suggest etching an opening in a substrate using an etchant comprising a carbon oxide, a fluorocarbon, an etch rate modulator, and an inert carrier gas, wherein a flow rate of said carbon oxide is greater than about 80 sccm and the etchant is selective to an aluminum oxide etch stop layer formed thereunder. Accordingly, Applicant respectfully submits that claim 1 and the claims dependent thereon are patentable over the references.

The Examiner rejected claims 11-14, 18-21 under 35 U.S.C.§ 103(a) as being unpatentable over Yang et al. (U.S. Patent 6,162,583) in view of Kim et al. (U.S. Patent 6,500,763) and further in view of Kim et al. (U.S. Patent 6,686,293).

Applicant respectfully submits that claim 11 and the claims dependent thereon are patentable over the references for reasons similar to those discussed above relative to claim 1. There is no disclosure or suggestion in the references of etching openings in a dielectric layer using an etchant comprising a carbon oxide, a fluorocarbon, an etch rate modulator, and an inert carrier gas, wherein a flow rate of the carbon oxide is greater than about 80 sccm and the etchant is selective to an aluminum oxide etch stop layer formed under the dielectric layer.

Applicant respectfully submits that claim 20 and the claims dependent thereon are patentable over the references for reasons similar to those discussed above relative to claim 1. There is no disclosure or suggestion in the references of etching openings in a dielectric layer using an etchant comprising a carbon oxide, a fluorocarbon, an etch rate modulator, and an inert carrier gas, wherein a flow rate of the carbon oxide is greater than about 80 sccm and the etchant is selective to an aluminum oxide etch stop layer formed under the dielectric layer.

The Examiner rejected claim 7 under 35 U.S.C.§ 103(a) as being unpatentable over Fitch et al. (U.S. Patent 5,324,683) in view of Kim et al. (U.S. Patent 6,500,763) and further in view of Kim et al. (U.S. Patent 6,686,293).

Applicant respectfully submits that claim 7 is patentable over the references as there is no disclosure or suggestion in the references of etching openings in a substrate using an etchant comprising a carbon oxide, a fluorocarbon, an etch rate modulator, and an inert carrier gas, wherein a flow rate of the carbon oxide is greater than about 80 sccm and the etchant is selective to an aluminum oxide etch stop layer formed thereunder, as required by claim 1. Fitch teaches etching through SiN and an oxide using an etch chemistry of CHF_3 or CF_4 combined with O_2 or CO_2 (Col. 9, lines 3-7). There is no suggestion that this etch is selective to an underlying etch stop layer, especially since this etch is taught for etching silicon nitride and oxide. In another embodiment, Fitch teaches a layer 38 (pad oxide) that functions as an etch stop, but fails to give an etchant chemistry selective to this etch stop.

Furthermore, while Kim ('763) teaches an auxiliary etch stop comprising SiN or aluminum oxide, there is no suggestion for replacing the pad oxide etch stop layer 38 of Fitch with aluminum oxide.

Still further, while Kim ('293) teaches a CO and/or Ar flow rate of 50-400 sccm, there is no disclosure or suggestion of an etchant comprising CO at a flow rate greater than 80 sccm that is selective to an underlying etch stop layer, much less an underlying aluminum oxide etch stop layer.

For the above reasons, Applicant respectfully submits that claim 7 is patentable over the references.

The Examiner rejected claim 17 under 35 U.S.C.§ 103(a) as being unpatentable over Fitch et al. (U.S. Patent 5,324,683) in view of Kim et al. (U.S. Patent 6,500,763) and further in view of Kim et al. (U.S. Patent 6,686,293).

Applicant respectfully submits that claim 17 is patentable over the references for reasons similar to those discussed above relative to claim 7.

The Examiner rejected claims 5, 15 under 35 U.S.C.§ 103(a) as being unpatentable over Yang et al. (U.S. Patent 6,162,583) in view of Kim et al. (U.S. Patent 6,500,763) and Kim et al. (U.S. Patent 6,686,293) and further in view of (US 2003/0127422A1).

Applicant respectfully submits that claims 5 and 15 are patentable over the references for the same reasons discussed above relative to claims 1 and 11, from which they respectively depend.

In light of the above, Applicant respectfully requests withdrawal of the Examiner's rejections and allowance of claims 1-5, 7-15, and 17-21. If the Examiner has any questions or other correspondence regarding this application, Applicant requests that the Examiner contact Applicant's attorney at the below listed telephone number and address.

Respectfully submitted,

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